WHAT IS CLAIMED IS:

1. A semiconductor device tester comprising

electron beam irradiation means for irradiating a semiconductor device as a sample under test with electron beam while scanning the semiconductor device;

by irradiation electron beam; and

data processing means for processing measured data from said current measuring means,

wherein said electron beam irradiation means includes collimator means for collimating electron beam to parallel beam and means for changing acceleration voltage of electron beam and wherein said data processing means includes means for obtaining an information related to a structure of the sample in a depth direction on the basis of a difference in transmittivity of electron beam for the sample when the latter is scanned with different acceleration voltages.

2. A semiconductor device tester as claimed in claim 1, further comprising means for moving said sample with respect to electron beam, wherein said electron beam irradiating means includes an electron gun and said collimator means includes a condenser lens for collimating electron beam emitted from said electron gun to parallel beam and an aperture plate having an aperture inserted into between said condenser lens and said sample for limiting a spot size of electron beam impinging said sample such that electron beam impinges an opening portion. The electron beam irradiation means preferably includes means for moving the sample under test with respect to electron beam in order to scan the sample with electron beam.

3. A semiconductor device tester as claimed in claim 1, further comprising means for moving said sample under test with respect to electron beam in order to scan said sample with electron beam, wherein said electron beam irradiation means includes an electron gun and said collimator means includes a first condenser lens for collimating electron beam emitted from said electron gun to parallel beam, a second condenser lens arranged such that said condenser lens constitutes an afocal system, an objective lens and an aperture plate having an aperture and inserted into between said first condenser lens and said second condenser lens for limiting a spot size of electron beam.

4. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiating means includes means for vertically irradiating said sample along a line segment passing through a center of a measuring region of said sample with electron beam having spot size smaller than an area of said measuring region and said data processing means includes means for obtaining a distance of a bottom of said measuring region from a space between a rising and falling edges of a current measured along said line segment.

5. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes area calculation means, which divides a value of current produced in an unknown measuring region by electron beam irradiation of said unknown region with electron bean under constant condition by a value of current produced in a known area of a measuring region of a standard sample by electron beam irradiation thereof with electron beam under the same constant condition and obtains the area of said unknown measuring region from a resulting quotient.

6. A semiconductor device tester as claimed in claim 5, wherein said data

processing means includes distance calculation means, which divides the area obtained by said area calculation means by the ratio of the circumference of a circle to its diameter and obtains a root of the resultant quotient as a distance measured from one edge to the other of said unknown measuring region.

7. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiation means includes means for setting the spot size of electron beam to a value large enough to cover a whole measuring region in the lump and said data processing means includes means for calculating a ratio of a value of current produced when a standard sample including a measuring region having a known area is irradiated with electron beam having the large spot size to a value of current produced when a measuring region of an unknown sample is irradiated with electron beam having the large spot size and means for calculating an area of the measuring region of the unknown sample from the ratio.

8. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes means for determining the value of current produced when a standard sample is irradiated with electron beam having known spot size as an amount of current per unit area of said standard sample.

9. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes means for comparing a current vale measured correspondingly to a positional coordinates when a wafer under test irradiated with electron beam with a current value to be measured at the same positional coordinates of the wafer is good and setting the kind of process to be performed next on the basis of the result of the comparison.

10. A semiconductor device tester as claimed in claim 1, further comprising a secondary electron detector for detecting secondary electron emitted from a surface of a sample under test, wherein said data processing means includes correspondingly processing means for processing an amount of secondary electron measured by said secondary electron detector correspondingly to the result of measurement of said current measuring means.

11. A semiconductor device tester as claimed in claim 10, wherein said electron beam irradiating means includes means for vertically irradiating said sample under test along a line segment passing through a center of a measuring region with electron beam having spot size smaller than an area of said measuring region and said correspondingly processing means includes means for obtaining a bottom distance of said measuring region from a distance between a rising and falling edges of current measured along said line segment by means of said current measuring means and means for obtaining an upper distance of said measuring region from a distance between a rising and falling edges of the secondary electron detected by said secondary electron detector.

12. A semiconductor device tester as claimed in claim 11, wherein said correspondingly processing means includes means for three-dimensionally displaying a circular pillar or a frustum of a cone having a bottom distance, an upper distance and a film thickness obtained from the information of the measured bottom distance, upper distance and film thickness of the measuring region as a bottom diameter, an upper diameter and a height.

13. A semiconductor device tester as claimed in claim 1, further comprising tilting means for tilting a sample stage on which a sample under test is mounted, wherein said data processing means includes means for processing a

tilting angle of the sample with respect to electron beam, which is realized by said tilting means.

14. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes recording means for storing a current value corresponding to an electron beam irradiating portion obtained in a location of the sample under test having no dust, means for comparing the current value stored in said recording means with a current value corresponding to an electron beam irradiating position in a pattern portion of an unknown sample, which is the same as a pattern portion of the sample under test and means for determining existence and size of dust from a difference between a rising and falling positions of the current value obtained by the comparison.

15. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiation means includes means for setting a cross sectional shape of electron beam such that it covers the whole measuring region in the lump and at least one end of the cross sectional shape of electron beam becomes linear and said data processing means includes means for obtaining the bottom distance of the measuring region from a distance between a rising value and a maximum value of current.

16. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiation means includes means for setting a cross sectional shape of electron beam such that it covers a whole measuring region in the lump and at least one end of the cross sectional shape of electron beam becomes linear and said data processing means includes means for calculating a differentiated curve of current value with respect to a distance and means for obtaining a radius of a bottom portion of the measuring region from a distance

between a rising position and an apex position of the differentiated curve.

17. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes means for displaying measured current values on a map corresponding to the measured positions.

18. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes comparison means for comparing a measured value obtained in one of two regions on a wafer as samples under test with a measured value obtained in the other region as a reference value and means for extracting a positional coordinates when there is a difference equal to or larger than a predetermined constant value.

19. A semiconductor device tester as claimed in claim 18, wherein said electron beam irradiation means includes means for scanning a sample under test with linear electron beam having length substantially equal to a width of a wiring in a direction perpendicular to a lengthwise direction of the linear line and moving a scan position by a distance equal to the width of the wiring vertically to scanning direction after one line scan is completed and said comparison means includes means for comparing current waveforms measured as variations of current values with respect to electron beam irradiating positions in the two regions.

20. A semiconductor device tester as claimed in claim 18, wherein said electron beam irradiation means includes means for scanning a sample under test with electron beam having size smaller than a minimum width of a wiring of the sample in a first direction and moving the scan position in a direction perpendicular to the scanning direction by a distance corresponding to the with

of the wiring every time one line scan is completed and said comparison means includes means for extracting, from current waveforms measured as variations of current values corresponding to electron beam irradiating positions in the two regions, instantaneous current values at centers of a rising and falling corresponding to the same pattern positions and comparing the instantaneous current values with each other.

21. A semiconductor device tester as claimed in claim 18, wherein said electron beam irradiation means includes means for scanning a sample under test with linear electron beam having a length capable of irradiating a plurality of wiring lines of the sample in the lump in a direction perpendicular to a lengthwise direction of the linear electron beam and moving the sample in a direction perpendicular to the scanning direction by a width of electron beam irradiating a scan position every time when one line scan is completed and said comparison means includes means for comparing current waveforms measured as variations of current values for electron beam irradiating positions in the two regions.

22. A semiconductor device tester as claimed in claim 21, wherein said means for comparing waveforms includes means for integrating the waveforms and comparing the integrated values.

23. A semiconductor device tester as claimed in claim 18, wherein said comparison means includes means for integrating current from a rising edge to a falling edge of one pulse of a current waveform measured as a variation of a value of current from an electron beam irradiating position, divider means for dividing the integrated value by a distance between the rising edge and the falling edge of the pulse and means for comparing current values per unit area

of the two regions obtained by said divider means.

24. A semiconductor device tester as claimed in claim 18, wherein said comparison means includes means for comparing positions of a rising edge and a falling edge of the pulse of the current waveform measured as a variation of current value for an electron beam irradiating position.

25. A semiconductor device tester as claimed in claim 18, wherein said comparison means includes means for comparing center positions of a rising edge position and a falling edge position of the pulse of the current waveform measured as a variation of current value for an electron beam irradiating position.

26. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiation means includes main scan means for moving a sample under test with respect to electron beam and sub scan means for repeatedly deflecting electron bean in a direction different from a main scan direction in combination on the main scan.

27. A semiconductor device tester as claimed in claim 1, wherein said electron beam irradiation means is capable of switching an operation mode between a first mode in which individual wiring lines of a sample under test are irradiated with electron beam and a second mode in which all of the wiring lines of the sample are irradiated with electron beam in the lump and said data processing means includes means for analyzing, every constant positional section, spacial frequency of current waveform measured as a variation of current value for electron beam irradiating position in the first mode and detecting a portion in which positional sections having the same spacial

frequency continue for a constant time period and means for, under an assumption that a plurality of wiring lines are arranged in an array in the detected position, setting the electron beam irradiation means to the second mode and obtaining defect ratio in the lump.

28. A semiconductor device tester as claimed in claim 1, said means for obtaining information related to the structure in the depth direction includes means for obtaining a three-dimensional configuration of a through-hole provided in an insulating film by measuring values of current produced by irradiation of electron beam passing through the insulating film surrounding the through-hole with increased acceleration voltage.

29. A semiconductor device tester as claimed in claim 28, further comprising means for tilting a sample stage having a sample under test mounted thereof, wherein said means for obtaining the three-dimensional configuration includes means for detecting whether a diameter of a through-hole is increased or decreased with depth, from measured values obtained when electron beam and an incident angle of electron beam to the sample are changed.

30. A semiconductor device tester as claimed in claim 1, wherein said means for obtaining information related to a structure in a depth direction includes means for detecting deviation of a circuit pattern in an insulating film from measured value of current produced by electron beam passing through the insulating film.

31. A semiconductor device tester as claimed in claim 30, wherein said means for detecting deviation of circuit pattern includes means for evaluating a

deviation of circuit patterns in respective layers from measured values when penetrating depth of electron beam is changed by changing acceleration voltage.

32. A semiconductor device tester as claimed in claim 30, further comprising means for taking in an information related to the circuit patterns from CAD data to obtain a position in which the circuit patterns overlap in the insulating layer.

33. A semiconductor device tester as claimed in claim 1, wherein said data processing means includes means for correcting current component flowing through a capacitance of a sample under test, which is caused by irradiation frequency of electron beam or scanning frequency.

34. A semiconductor device tester as claimed in claim 33, further comprising means for changing a repetition period of electron beam, wherein said electron beam irradiation means has a construction in which pulsed electron beam is generated repeatedly and said correcting means includes means for obtaining the D.C. component by extrapolation of current value when the sample is continuously irradiated with electron beam from current values measured by the current measuring means when the sample is irradiated with electron beam with different repetition period.

35. A semiconductor device tester as claimed in claim 33, further comprising means for switching scan speed of electron beam from said electron beam irradiation means, wherein said correcting means includes means for obtaining a current value when the scanning speed, which is zero, is extrapolated from the current values measured by said current measuring

means when the sample is scanned by electron beam at different scan speeds.